

## WHAT IS CLAIMED IS:

1. A method for assigning tester interface pins to tester fixture probes  
in a constrained pin-to-probe assignment problem describing a printed circuit  
board tester environment, said constrained pin-to-probe assignment problem  
defined by a set of constraints, said set of constraints including: a set of  
nodes each needing at least one resource, a plurality of tester resources  
wherein said plurality of resources may comprise a plurality of non-disjoint  
groupings of resources wherein each grouping realizes a test, a plurality of  
tester interface pins each connectable to one or more of said tester  
resources and may be physically grouped into one or more tester modules,  
said plurality of tester interface pins comprising a plurality of disjoint pin  
groupings wherein each pin grouping comprises a plurality of tester interface  
pins that are multiplexed together and that cannot be used simultaneously in  
any given test, a plurality of probes each connectable to at least one node  
and to only one of said tester interface pins to deliver a single tester  
resource to said node during any given test and the same or a different  
tester resource for any other given test, and wherein no two nodes can share  
a pin, and a plurality of tests which may include a subset of tests where each  
test in said subset of tests requires tester resources to be delivered and/or  
measured from said tester interface pins from a single given module of said  
one or more tester modules, said method comprising:  
modeling said constrained pin-to-probe assignment problem as a  
Matching Problem that satisfies said set of constraints; and  
solving said Matching Problem that satisfies said set of constraints to  
generate a solution to said constrained pin-to-probe assignment problem.

2. A method in accordance with claim 1, wherein:  
said solution comprises a maximum matching.

3. A method in accordance with claim 1, wherein:  
said solving step generates a plurality of solutions, each said solution  
having an associated priority.

4. A method in accordance with claim 3, further comprising:  
2 selecting a solution from said plurality of solutions, said selected  
solution having a corresponding priority that is relatively equal to or higher  
4 than each of said respective priorities associated with each other of said  
plurality of solutions.

5. A method in accordance with claim 1, wherein:  
2 said step for modeling said pin-to-probe assignment problem as a  
Matching Problem that satisfies said constraints comprises:  
4 for each of said plurality of probes connectable to deliver more than  
one tester resource:  
6 for each tester resource greater than one:  
creating a dummy probe, said dummy probe comprising  
8 a virtual probe that operates as a placemaker for said probe;  
mapping said tester resource to said dummy probe;  
10 unmapping said tester resource from said probe; and  
associating said dummy probe with said probe; and  
12 wherein said step for solving said Matching Problem that satisfies said  
set of constraints comprises:  
14 once a solution to said Matching Problem that satisfies said set of  
constraints is obtained, reassigning each pin in the solution that has been  
16 assigned to a dummy probe to the probe associated with the dummy probe  
and removing said dummy probe from said solution.

6. A method in accordance with claim 1, wherein:  
2 said step for modeling said pin-to-probe assignment problem as a  
Matching Problem that satisfies said constraints comprises:  
4 for each test in said subset of tests that requires tester resources to  
be delivered and/or measured from said tester interface pins from a single  
6 given module of said one or more tester modules:  
for each module that provides all tester resources required by  
8 said test:  
for each said tester resources required by said test:  
10 for each probe that handles said resource:

if said probe is unmapped:  
12 mapping said resource to said  
probe;  
14 if said probe is mapped:  
creating a dummy probe;  
16 mapping said resource to said  
dummy probe;  
18 associating said dummy probe with  
said probe; and  
20 mapping said dummy probe to said  
tester interface pins in said module that  
22 can connect to said resource in said  
module; and  
24 wherein said step for solving said Matching Problem that satisfies said  
set of constraints comprises:  
26 once said solution to said constrained pin-to-probe assignment  
problem is obtained, for each test in said subset of tests that requires tester  
28 resources to be delivered and/or measured from said tester interface pins  
from a single given module of said one or more tester modules:  
30 selecting one of said modules that provides all tester resources  
required by said test in which a pin-to-probe assignment solution is  
32 found;  
reassigning each pin in said solution that has been assigned to  
34 a dummy probe to the probe associated with the dummy probe and  
removing said dummy probe from said solution;  
36 and for each remaining module that provides all tester resources  
required by said test, removing all portions of said solution associated with  
38 said test from said remaining module.

7. A method in accordance with claim 6, wherein:  
2 said step for selecting one of said modules that provides all tester  
resources required by said test in which a pin-to-probe assignment solution  
4 is found comprises:

selecting said module in which said pin-to-probe assignment solution  
6 for said test is the least- or equally-least cost solution.

8. A method in accordance with claim 1, wherein:

2 for each test:

for each said plurality of disjoint pin groupings wherein each pin  
4 grouping comprises a plurality of tester interface pins that are multiplexed  
together and that cannot be used simultaneously in any given test:

6 determining whether said solution to said constrained pin-to-probe  
assignment problem contains pin-to-probe assignments that include pins  
8 from said disjoint pin grouping; and

if said solution to said constrained pin-to-probe assignment problem  
10 contains pin-to-probe assignments that do include pins from said disjoint pin  
grouping, said step for solving said Matching Problem that satisfies said set  
12 of constraints is repeated to generate an alternative solution to said  
constrained pin-to-probe assignment problem, if said alternative solution  
14 exists.

9. A method in accordance with claim 1, wherein said step for solving  
2 said Matching Problem that satisfies said set of constraints to generate a  
solution to said constrained pin-to-probe assignment problem comprises:

4 initializing said solution to an empty set and a flow associated with  
said solution to zero;

6 searching for a flow-augmenting path that satisfies said set of  
constraints;

8 if said flow-augmenting path is found, replacing said matching solution  
with the Exclusive-OR function of the matching solution and the flow-  
10 augmenting path;

augmenting said flow along said flow-augmenting path; and

12 repeating said searching step through said repeating step until a flow-  
augmenting path is not found.

10. A method in accordance with claim 5, wherein:

2           said step for modeling said pin-to-probe assignment problem as a  
Matching Problem that satisfies said constraints comprises:

4           for each test in said subset of tests that requires tester resources to  
be delivered and/or measured from said tester interface pins from a single  
6           given module of said one or more tester modules:

              for each module that provides all tester resources required by  
8           said test:

                  for each said tester resources required by said test:

10                   for each probe that handles said resource:

                          if said probe is unmapped:

12                           mapping said resource to said  
probe;

14                           if said probe is mapped:

                                  creating a dummy probe;

16                           mapping said resource to said  
dummy probe;

18                           associating said dummy probe with  
said probe; and

20                           mapping said dummy probe to said  
tester interface pins in said module that  
22                           can connect to said resource in said  
module; and

24           wherein said step for solving said Matching Problem that satisfies said  
set of constraints comprises:

26           once said solution to said constrained pin-to-probe assignment  
problem is obtained, for each test in said subset of tests that requires tester  
28           resources to be delivered and/or measured from said tester interface pins  
from a single given module of said one or more tester modules:

30                   selecting one of said modules that provides all tester resources  
required by said test in which a pin-to-probe assignment solution is  
32                   found;

                  reassigning each pin in said solution that has been assigned to  
34                   a dummy probe to the probe associated with the dummy probe and  
removing said dummy probe from said solution;

36           and for each remaining module that provides all tester resources  
required by said test, removing all portions of said solution associated with  
38   said test from said remaining module.

11. A method in accordance with claim 10, wherein:  
2           said step for selecting one of said modules that provides all tester  
resources required by said test in which a pin-to-probe assignment solution  
4   is found comprises:  
          selecting said module in which said pin-to-probe assignment solution  
6   for said test is the least- or equally-least cost solution.

12. A method in accordance with claim 10, wherein:  
2           for each test:  
          for each said plurality of disjoint pin groupings wherein each pin  
4   grouping comprises a plurality of tester interface pins that are multiplexed  
together and that cannot be used simultaneously in any given test:  
6           determining whether said solution to said constrained pin-to-probe  
assignment problem contains pin-to-probe assignments that include pins  
8   from said disjoint pin grouping; and  
          if said solution to said constrained pin-to-probe assignment problem  
10   contains pin-to-probe assignments that do include pins from said disjoint pin  
grouping, said step for solving said Matching Problem that satisfies said set  
12   of constraints is repeated to generate an alternative solution to said  
constrained pin-to-probe assignment problem, if said alternative solution  
14   exists.

13. A method for assigning tester interface pins to tester fixture  
2   probes in a constrained pin-to-probe assignment problem describing a  
printed circuit board tester environment, said constrained pin-to-probe  
4   assignment problem defined by a set of constraints, said set of constraints  
including: a set of nodes each needing at least one resource, a plurality of  
6   tester resources wherein said plurality of resources may comprise a plurality  
of non-disjoint groupings of resources wherein each grouping realizes a test,  
8   a plurality of tester interface pins each connectable to one or more of said

tester resources and may be physically grouped into one or more tester  
10 modules, said plurality of tester interface pins comprising a plurality of  
disjoint pin groupings wherein each pin grouping comprises a plurality of  
12 tester interface pins that are multiplexed together and that cannot be used  
simultaneously in any given test, a plurality of probes each connectable to at  
14 least one node and to only one of said tester interface pins to deliver a single  
tester resource to said node during any given test and the same or a  
16 different tester resource for any other given test, and wherein no two nodes  
can share a pin, and a plurality of tests which may include a subset of tests  
18 where each test in said subset of tests requires tester resources to be  
delivered and/or measured from said tester interface pins from a single given  
20 module of said one or more tester modules, said method comprising:  
modeling said constrained pin-to-probe assignment problem as a  
22 Network Flow Problem that satisfies said set of constraints; and  
solving said Network Flow Problem using a modified Maximum Flow  
24 Algorithm that satisfies said set of constraints to generate a solution to said  
constrained pin-to-probe assignment problem.

14. A method in accordance with claim 13, wherein:  
2 said solution comprises a maximum matching.

15. A method in accordance with claim 13, wherein:  
2 said solving step generates a plurality of solutions, each said solution  
having an associated priority.

16. A method in accordance with claim 15, further comprising:  
2 selecting a solution from said plurality of solutions, said selected  
solution having a corresponding priority that is relatively equal to or higher  
4 than each of said respective priorities associated with each other of said  
plurality of solutions.

17. A method in accordance with claim 13, wherein:  
2 said step for modeling said pin-to-probe assignment problem as a  
Network Flow Problem that satisfies said constraints comprises:

4           for each of said plurality of probes connectable to deliver more than  
one tester resource:  
6           for each tester resource greater than one:  
            creating a dummy probe, said dummy probe comprising  
8           a virtual probe that operates as a placemaker for said probe;  
            mapping said tester resource to said dummy probe;  
10           unmapping said tester resource from said probe; and  
            associating said dummy probe with said probe; and  
12          wherein said step for solving said Network Flow Problem that satisfies  
said set of constraints comprises:  
14          once a solution to said Network Flow Problem that satisfies said set of  
constraints is obtained, reassigning each pin in the solution that has been  
16          assigned to a dummy probe to the probe associated with the dummy probe  
and removing said dummy probe from said solution.

18. A method in accordance with claim 13, wherein:  
2          said step for modeling said pin-to-probe assignment problem as a  
Network Flow Problem that satisfies said constraints comprises:  
4          for each test in said subset of tests that requires tester resources to  
be delivered and/or measured from said tester interface pins from a single  
6          given module of said one or more tester modules:  
            for each module that provides all tester resources required by  
8          said test:  
                for each said tester resources required by said test:  
10                  for each probe that handles said resource:  
                    if said probe is unmapped:  
12                          mapping said resource to said  
probe;  
14                      if said probe is mapped:  
                        creating a dummy probe;  
16                          mapping said resource to said  
dummy probe;  
18                      associating said dummy probe with  
said probe; and



20 mapping said dummy probe to said  
tester interface pins in said module that  
22 can connect to said resource in said  
module; and  
24 wherein said step for solving said Network Flow Problem that satisfies  
said set of constraints comprises:  
26 once said solution to said constrained pin-to-probe assignment  
problem is obtained, for each test in said subset of tests that requires tester  
28 resources to be delivered and/or measured from said tester interface pins  
from a single given module of said one or more tester modules:  
30 selecting one of said modules that provides all tester resources  
required by said test in which a pin-to-probe assignment solution is  
32 found;  
reassigning each pin in said solution that has been assigned to  
34 a dummy probe to the probe associated with the dummy probe and  
removing said dummy probe from said solution;  
36 and for each remaining module that provides all tester resources  
required by said test, removing all portions of said solution associated with  
38 said test from said remaining module.

19. A method in accordance with claim 18, wherein:  
2 said step for selecting one of said modules that provides all tester  
resources required by said test in which a pin-to-probe assignment solution  
4 is found comprises:  
selecting said module in which said pin-to-probe assignment solution  
6 for said test is the least- or equally-least cost solution.

20. A method in accordance with claim 13, wherein:  
2 for each test:  
for each said plurality of disjoint pin groupings wherein each pin  
4 grouping comprises a plurality of tester interface pins that are multiplexed  
together and that cannot be used simultaneously in any given test:

6           determining whether said solution to said constrained pin-to-probe  
assignment problem contains pin-to-probe assignments that include pins  
8           from said disjoint pin grouping; and  
            if said solution to said constrained pin-to-probe assignment problem  
10           contains pin-to-probe assignments that do include pins from said disjoint pin  
grouping, said step for solving said Network Flow Problem that satisfies said  
12           set of constraints is repeated to generate an alternative solution to said  
constrained pin-to-probe assignment problem, if said alternative solution  
14           exists.

21. A method in accordance with claim 13, wherein said step for  
2           solving said Network Flow Problem that satisfies said set of constraints to  
generate a solution to said constrained pin-to-probe assignment problem  
4           comprises:  
            initializing said solution to an empty set and a flow associated with  
6           said solution to zero;  
            searching for a flow-augmenting path that satisfies said set of  
8           constraints;  
            if said flow-augmenting path is found, replacing said matching solution  
10           with the Exclusive-OR function of the matching solution and the flow-  
augmenting path;  
12           augmenting said flow along said flow-augmenting path; and  
            repeating said searching step through said repeating step until a flow-  
14           augmenting path is not found.

22. A method in accordance with claim 17, wherein:  
2           said step for modeling said pin-to-probe assignment problem as a  
Network Flow Problem that satisfies said constraints comprises:  
4           for each test in said subset of tests that requires tester resources to  
be delivered and/or measured from said tester interface pins from a single  
6           given module of said one or more tester modules:  
            for each module that provides all tester resources required by  
8           said test:  
                for each said tester resources required by said test:

10                   for each probe that handles said resource:  
                    if said probe is unmapped:  
12                         mapping said resource to said  
                    probe;  
14                   if said probe is mapped:  
                    creating a dummy probe;  
16                         mapping said resource to said  
                    dummy probe;  
18                         associating said dummy probe with  
                    said probe; and  
20                         mapping said dummy probe to said  
                    tester interface pins in said module that  
22                         can connect to said resource in said  
                    module; and  
24           wherein said step for solving said Matching Problem that satisfies said  
set of constraints comprises:  
26           once said solution to said constrained pin-to-probe assignment  
problem is obtained, for each test in said subset of tests that requires tester  
28           resources to be delivered and/or measured from said tester interface pins  
from a single given module of said one or more tester modules:  
30                 selecting one of said modules that provides all tester resources  
                    required by said test in which a pin-to-probe assignment solution is  
32                 found;  
                    reassigning each pin in said solution that has been assigned to  
34                 a dummy probe to the probe associated with the dummy probe and  
                    removing said dummy probe from said solution;  
36                 and for each remaining module that provides all tester resources  
required by said test, removing all portions of said solution associated with  
38           said test from said remaining module.

23. A method in accordance with claim 22, wherein:

2           said step for selecting one of said modules that provides all tester  
resources required by said test in which a pin-to-probe assignment solution  
4           is found comprises:

selecting said module in which said pin-to-probe assignment solution  
6 for said test is the least- or equally-least cost solution.

24. A method in accordance with claim 22, wherein:  
2 for each test:  
for each said plurality of disjoint pin groupings wherein each pin  
4 grouping comprises a plurality of tester interface pins that are multiplexed  
together and that cannot be used simultaneously in any given test:  
6 determining whether said solution to said constrained pin-to-probe  
assignment problem contains pin-to-probe assignments that include pins  
8 from said disjoint pin grouping; and  
if said solution to said constrained pin-to-probe assignment problem  
10 contains pin-to-probe assignments that do include pins from said disjoint pin  
grouping, said step for solving said Network Flow Problem that satisfies said  
12 set of constraints is repeated to generate an alternative solution to said  
constrained pin-to-probe assignment problem, if said alternative solution  
14 exists.